REMARKS

Claims 1-5, 24 and 25 are pending in the application. In the Office Action at hand, those claims are rejected.

Claims 1-5 are rejected under 35 U.S.C. §103(a) as being unpatentable over Reuter, Helfritch and Patrick. In addition, Claims 24 and 25 are rejected under Section 103(a) as being unpatentable over Retuer, Helfritch, Patrick, Namba and Hirai. In response to the Section 103(a) rejections, the Applicant respectfully submits that Claims 1-5, 24 and 25, as amended, are not obvious in view of Reuter, Helfritch, Patrick, Namba and Hirai. Reconsideration is respectfully requested.

Claim 1, as amended, recites a gas conversion system for removing NOx and SOx from gases, and includes a duct having a rectangular cross section having a width and height through which the gases flow. The duct can have a port for introducing a reaction agent into the duct to the gases. First and second electron beam emitters each having a single exit window can be mounted to the duct and sealed over openings in the duct opposite from each other in opposed axial alignment for directing opposed electron beams into the duct and causing components of the NOx, SOx and reaction agent to react to remove NOx and SOx from the gases. The duct can be shaped and sized, and the electron beam emitters can be operated, positioned, configured, shaped and sized to generate generally axially straight uniform electron beams directed into the rectangular cross section of the duct that are shaped to axially combine together provide complete continuous uniform rectangular electron beam coverage across the width and height of the rectangular cross section of the duct with generally evenly dispersed electrons. Claim 3, as amended, recites a treatment system, and Claim 4, as amended, recites an electron beam treatment system.

Claims 1, 3 and 4 have been amended to recite "first and second electron beam emitters each having a single exit window mounted to the duct and sealed over openings in the duct opposite from each other in opposed axial alignment", and "the electron beam emitters being operated, positioned, configured, shaped and sized to generate generally axially straight uniform electron beams directed into the rectangular cross section of the duct that are shaped to axially combine together to provide complete continuous uniform rectangular electron beam coverage across the width and height of the rectangular cross section of the duct with generally evenly

dispersed electrons." Support for these amendments is found at least in FIGs. 3-5, as well as on page 5, lines 3-9, page 7, lines 9-12, and page 9, lines 10-25 of the Specification as originally filed.

In embodiments of the claimed invention, the electron beam emitters can provide generally axially straight uniform electron beams having generally evenly dispersed electrons to provide complete continuous uniform electron beam coverage across the width and height of the rectangular cross section of the duct, for example, as seen in FIGs. 3 and 4. The electron beam emitters are mounted in opposed axial alignment and sealed over openings in the duct in a manner to allow complete coverage. The generally axially straight uniform electron beams with generally evenly dispersed electrons, can have a generally axially straight or non spreading configuration that can be evenly directed straight into the rectangular duct and parallel to the side walls. Therefore, the opposed generally axially straight uniform electron beams have a shape that can be easily directed into a rectangular cross section duct and combined together to provide complete, continuous and uniform or even rectangular electron beam coverage with evenly dispersed electrons across the width and height of the rectangular cross section of the duct. In addition, by continuously generating the electron beams, complete continuous uniform coverage is obtained not only physically across the cross section of the duct, but also in electron beam duration at any given moment in time, in contrast to pulsed beams, or scanned beams. As a result, a gas, compound or substance flowing through the duct can be generally evenly, completely, uniformly and continuously treated with electrons at any particular width or height location and time within the rectangular cross section of the duct, thereby resulting in consistent and thorough treatment.

In contrast, Reuter discloses a device for desulphurizing and denitrating flue gases having opposed electron accelerators 2 for irradiating gases flowing through a reaction canal 6. Each electron accelerator 2 has digital electron beam deflection 3 and scanning system 4. This results in an electron beam which is scanned or moved back and forth in an outwardly angled spreading or diverging formation as it enters the reaction canal 6, as seen in Fig. 2. The electron beam moves back and forth in order to sequentially or progressively cover the cross section of the reaction canal 6. As a result, at a given moment in time, there is always a portion of the reaction canal 6 that is not physically covered by the electron beam, resulting in nonuniform coverage at a particular moment in time, and in certain circumstances some gas could pass by

without being irradiated. Since the electron beam is diverging, the electrons spread out and diverge from each other moving away from the electron accelerator 2, and the diverging effect would be more noticable or pronounced near the side regions of the electron beam. Consequently, the concentration or dispersion of the electrons in the reaction canal 6 from each electron accelerator 2 can be less at the sides of the reaction canal 6. Less electrons at the sidewalls of the reaction canal 6 can also result from the fact that some electrons at the sides of the diverging beam enter at an angle and hit the sidewalls, and therefore do not travel the entire desired distance into the reaction canal 6. Therefore, uneven or nonuniform dispersion of electrons across the cross section of the reaction canal 6 can have higher concentrations at the center, and lower concentrations at the sides. An example of uneven or nonuniform dispersion of electrons and treatment from diverging electron accelerators can be seen in Fig. 1 of U.S. 5,015,443 (Ito), which was discussed in the Amendment filed by the Applicant on 9/24/2007. Although column 3, lines 15-27 of Reuter describes that the electron digital beam deflection can cause electron distribution in the reaction vessel to be adjusted substantially rectangularly, since the electron beams are diverging, the term "substantially rectangularly" appears to mean that the diverging beam is merely adjusted to a diverging angle of an amount that can be directed within the rectangular reaction canal 6, as seen in FIG. 2.

The graph of Fig. 4 of Reuter is an ionization curve for two sided irradiation, depicting the percentage of ionization for a certain amount of gas given in units g/m2. This graph in Fig. 4 does not show the distribution of electrons across the cross section of the reaction canal 6, but rather the amount of gas ionized. Gas can be sufficiently ionized by unevenly or nonuniformly dispersed electrons, if the power is high enough so that the power in the regions having less electrons is at a high enough level. However, this can result in less efficient operation than in the present invention since central regions can have more than the required power. Evidence that the electron beam coverage across the cross section of reaction canal 6 is not uniform is found on column 3, lines 24-26 of Reuter which states that the "uniformity of the irradiation can be improved by the production of a turbulence within the reactor". Having turbulence can cause gases to move vertically or laterally across the cross section of the reaction canal while traveling longitudinally through the reaction canal. When the electron beam coverage is not uniform, such turbulence can result in more uniform irradiation if the path of the gases can pass through both higher and lower regions of irradiation in the reaction canal. In contrast, when there is no

turbulence, different regions of the gases might only pass through a higher or only through a lower region of irradiation, resulting in nonuniform irradiation.

Consequently, since Reuter has a scanned diverging beam as discussed above, Reuter does not have "generally axially straight uniform electron beams directed into the rectangular cross section of the duct that are shaped to axially combine together to provide complete continuous uniform rectangular electron beam coverage across the width and height of the rectangular cross section of the duct", as recited in the claimed invention.

Helfritch discloses in FIG. 1 an electron beam gas scrubbing apparatus 10 which irradiates flue gases with pulsed or intermittent electron beams from electron accelerators 36 and has a source for adding ammonia. Helfritch shows in FIG. 1, three electron accelerators 36 mounted on one side of the reactor sequentially in the direction of flow, but can also employ six accelerators. By having pulsed electron accelerators 36, there is not complete continuous uniform electron beam coverage since the electron beams turn on and off, and some gas could in some circumstances, pass by a particular accelerator 36 without being irradiated. Helfritch does not teach or suggest opposed emitters, the shape of the electron beam that is generated, or the cross sectional shape of the conduit 34 that is irradiated by the electron accelerators 36. Since Helfitch teaches pulsed or intermittent electron beams, and does not specifically teach the cross sectional shape of the conduit or the shape of the electron beams, Helfritch cannot teach or suggest complete continuous uniform electron beam coverage across the width and height of a rectangular duct. However, it appears that the cross section of conduit 34 has a round shape based on FIG. 1 and the related description. Reference numeral 38 is described as a "conduit or pipe" on column 4, line 8, and in FIG. 1, is shown to be a continuation of conduit 34. Also in FIG. 1, the broken ends of the inlet and outlet pipes of apparatus 10 which includes conduit 34, are depicted with the standard drafting designation for round pipes.

Patrick discloses a treatment apparatus including a duct 12 having opposed electron beam guns 22 mounted to the duct 12. As can be seen in FIGs. 5 and 6, the windows 11 of the electron beam guns 22 extend only across the middle half of the duct 12, and as a result, the other 50% of the width or cross section of the duct 12 may not experience electron beam coverage (See FIG. 6). To compensate for the partial electron beam coverage, the interior of the duct 12 includes drag elements 23 and spaced apart bars 24 which direct the majority of flow toward the center of the duct 12 in line with the electron beam window 11. Since the bars 24 are spaced apart, a

percentage of the flow will likely pass through the spaces between the bars 24 and get past the electron beam window 11 in regions that do not have electron beam coverage (50% of the duct's width or cross section), thereby escaping irradiation. The use of the bars 24 in Patrick teach away from having complete continuous rectangular electron beam coverage across the width and height of the rectangular cross section of the duct, such as in the present invention, as now claimed.

Accordingly, Claims 1-5, as amended, are not obvious in view of Reuter, Helfritch, and Patrick, since none of the references, alone or in combination, teach or suggest "the duct being shaped and sized, and the electron beam emitters being operated, positioned, configured, shaped and sized <u>to generate generally axially straight uniform electron beams directed into the rectangular cross section of the duct that are shaped to axially combine together to provide complete continuous uniform rectangular electron beam coverage across the width and height of the rectangular cross section of the duct with generally evenly dispersed electrons</u>," as recited in Claims 1, 3 and 4, as amended. Therefore, Claims 1-5, as amended, are in condition for allowance. Reconsideration is respectfully requested.

Namba discloses in FIG. 1, an irradiation chamber 2 irradiated by three electron beam generators 1 positioned and spaced apart from or above the irradiation chamber 2 sequentially in the direction of flow. As a result, the electron beam generators 1 are not mounted to and sealed over openings in the irradiation chamber 2, and the gas passes through both irradiation zones 3 and non irradiation zones 4. Column 3 teaches that ozone is generated by the electron beams. FIG. 2 discloses that a series of electron beam generators can be positioned spaced under or below the irradiation chamber 2 to provide opposed electron beams within the irradiation chamber 2. Namba does not disclose the cross sectional shape of the irradiation chamber 2, since FIGs. 1 and 2 only show side views. Therefore, Namba does not teach a duct with a rectangular cross section, as recited in the claimed invention. Additionally, the shape of the electron beams shown in FIGs. 1 and 2 have widths that vary with the distance or height away from the electron beam generators. In FIG. 1, the electron beams generated are narrower at the top and bottom, and in FIG. 2, the electron beams appear generally cone shaped and began to narrow at the center of the irradiation chamber 2. For electron beams as shaped in FIG. 2, there would be portions of the cross sectional area of the duct absent of electron beam coverage at least at the corners and possibly at the mid point of the left and right side edges, even if the duct were to have a

rectangular cross section. It would appear that having nonirradiated portions of the cross section in Namba is not an issue since Namba relies on using nonirradiation zones 4 adjacent to irradiation zones 3 for improving the efficiency of nitrogen oxide removal.

Hirai discloses in Fig. 1 a deodorizing apparatus 10 having a UV lamp 30 and an ozone decomposing catalyzing layer 34 for decomposing ozone.

Accordingly, Claims 24 and 25, are not obvious in view of Reuter, Helfritch, Patrick Namba and Hirai, since none of the references, alone or in combination, teach or suggest "the duct being shaped and sized, and the electron beam emitters being operated, positioned, configured, shaped and sized to generate generally axially straight uniform electron beams directed into the rectangular cross section of the duct that are shaped to axially combine together to provide complete continuous uniform rectangular electron beam coverage across the width and height of the rectangular cross section of the duct with generally evenly dispersed electrons," as recited in base Claim 4, as amended. Therefore, Claims 24 and 25 are in condition for allowance. Reconsideration is respectfully requested.

CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned.

Respectfully submitted,

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